ETHNOBOTANICAL STUDY ON ANGIOSPERMS OF NURPUR FOREST DIVISION IN DISTRICT KANGRA OF HIMACHAL PRADESH

SYNOPSIS

Submitted in partial fulfillment of the

requirements for the award of the degree of

DOCTOR OF PHILOSOPHY

in

BOTANY

Submitted by

Anupriya Sharma
Enrolment No.: H14103

Under the Supervision of

Dr. Arti Sharma
Assistant Professor

DIVISION OF BOTANY
DEPARTMENT OF BIO SCIENCES
SCHOOL OF BASIC AND APPLIED SCIENCES
CAREER POINT UNIVERSITY HAMIRPUR
TIKKER (KHARWARIAN), BHORANJ
HAMIRPUR (HP)-176041, INDIA

2021-2022

INTRODUCTION:

Almost 80% of the human population still relies on plant based medicines despite the heavy flow and demand of synthetic drugs in the market (World Health Organization, 2014). Different countries accumulated different medicinal system based on their knowledge and culture, such as Ayurveda in India, Kampo in Japan, Tibetan medicine system, Chinese medicine system, Korean medicine and Unani Perso-Arabic traditional medicine system practiced in Muslim culture in South Asia and Central Asia (Kim, Pham & Koh, 2011). Ethnobotany is a branch of botany which deals with inter-relationship between human being and plants (Jain, 1987). Ethnobotany can be summed up in four words: people, plants, interactions, and uses (Abbasi et al., 2013). For human existence, since ancient times, especially, the ethnic or tribal community has a great dependence on local flora for medicinal and other purposes (Raghuvanshi et al., 2021). Ethnobotanical information on important plants and their use by local inhabitants is useful not only in conservation of traditional knowledge and biodiversity, but also to improve community health care (Farooq, Saggoo & Dar, 2014). Hence, documentation of the use of plants through ethnobotanical studies enables the development of contemporary drugs.

India is one of the twelve mega-biodiversity countries of the world having rich vegetation with a wide variety of plants with medicinal value (Ramkumar & Karuppusamy, 2021). It included about 17,000 species of higher plants, of which approximately 8,000 species are considered medicinal and used by village communities, particularly tribal communities, or in traditional medicinal systems, such as the Ayurveda (Kanta, Sharma & Sheikh, 2018). Ayurveda is the oldest system of medicine in the world and the most commonly practiced form of non allopathic medicine in India, particularly in rural India (Gogtay et al., 2002). More than 80% of therapeutic products are derived from plants and have been used for 6000 -7000 years; hence our country possesses an ancient system of health care (Balakrishanan et al., 2009). From ancient literature to modern scientific records of traditional medicinal knowledge, there is evidence that majority of rural people in India use the plants which are in and around their locality as primary health care.

The old Indian literature such as Rig-veda, Atharveda, Charka Samhita, included various uses of plants of Himalaya region (Tripathi, Kumar & Sati, 2020). One of the earth's most multifaceted and diverse montane ecosystems, characterized by a harsh climate, a strong degree of seasonality and a high diversity of both plant communities and species lies in the

Himalayas (Kala & Mathur, 2002; Oommen & Shanker, 2005). Himachal Pradesh lies in the lap of North West Himalayas and comprises a good heritage of ethnobotanical flora and natural wealth (Uniyal et al., 2006). In Himachal Pradesh approximately 3500 plant species are known and around 500 are accounted for the therapeutic uses (Chauhan, 2003).The high species richness and diverse community structure makes Himachal Pradesh suitable for ethno botanical exploration.

Nurpur is a Forest Division under Dharamshala Circle of Kangra district in the Indian state of Himachal Pradesh. Nurpur and its surrounding areas have the natural beauty of forests, rivers, valleys, hills and dales, which are rich in material resources as in cultural and human values. Nurpur was a princely state ruled by the Pathania clan of Rajputs (Imperial Gazetteer of India, Vol 19). According to Tribal Development Department (2011) Nurpur Division has dispersed tribal population of Hindu Gujjars, Muslim Gujjars and Gaddis of Chamba.

LITERATURE REVIEW:

Significant work has been carried out on ethnobotanical studies worldwide. Almedia et al. (2006) gave an account of 187 medicinal species which were cited from 64 families and 128 genera for their medicinal value in north eastern Brazil. Vitalini et al. (2013) conducted a survey on the ethnobotanical investigations in the Italian Alps and documented 66 plant species used as medicine. Tefera & Kim (2019) documented the existence of indigenous knowledge of medicinal plants to treat human and livestock ailments in Southern Ethiopia. Amiri et al. (2020) documented ethnomedicinal usages of 90 *Astragalus* taxa which mainly originated from Asia and Europe. Belgica, Suba & Alejandro (2021) reported 74 medicinal plants from 38 families in Philippine barangay.

In Asian countries like China, India, Nepal, and Bangladesh, ethnobotany has been employed widely in the documentation of traditional knowledge and inventory of herbal medicines (Sheng-Ji, 2001). Miya, Timilsina & Chhetri (2020) documented about 215 plant species which are used to treat 139 types of diseases by major ethnic peoples in hilly region of Nepal. Wang et al. (2021) described that a total of 102 species of plants can treat 71 human ailments of the Chuanqing people in China.

In India, Choudhary, Singh & Pillai (2008) revealed that Dr. Aromal and Dr. Jain in 1960's were the first individuals who initiated researches on ethnobotany in Botanical Survey of India, they studied the food plants of certain tribals of South India and started intensive field work among the tribal's of Central India respectively. Many workers contributed to the field of ethnobotany and ethnomedicine in India like, Rao & Jamir, (1982) in Nagaland;

Reddy et al. (2005) in Andhra Pradesh; Singh, Raguvanshi & Singh, (2002) in Uttar Pradesh. Kala (2009) have recorded 73 ethnobotanical species used as medicine by tribal and non-tribal communities in southern part of Surguja of Chhattisgarh. Dhal, Panda & Muduli, (2014) reported a total of 69 plant species belonging to 43 families for each species the ethno botanical information were provided in Nawarangpur, Odisha. Bhattacharyya et al. (2020) enumerated the ethnobotanical investigation of total of 39 species of medicinal plants by tea tribes in Assam. Pala et al. (2021) throw a light on 135 plant species belonging to 121 genera which were being utilized as forest resources and medicine in Kashmir Himalayas.

In Himachal Pradesh, Sharma & Rana (1999) enlisted the ethnobotanical, ayurvedic and pharmacological use of 27 plant species which were used in rural area in Himachal hills. A brief ethnobotanical account of 109 plant species belonging to 41 families and 86 genera of Kullu district in North Western Himalayan have been recorded by Singh (2000). Negi & Chauhan (2009) have discussed the ethnobiological uses of a total of 103 species of the tribal district Kinnaur. Bharadwaj & Seth (2017) carried out an ethno-botanical exploration of tropical areas of Himachal Pradesh (Bilaspur, Hamirpur and Una) to enumerate few imperative medicinal plant species used by the inhabitant to cure different ailments. Radha et al. (2019) documented a total of 44 commonly used ethnomedicinal plants in Summer Hill Shimla. Pal, Dutt & Attri (2020) gave an account on 48 plant species traditionally used as medicine in mid Himalayan region of Himachal Pradesh.

In District Kangra, Sharma et al. (2014) documented 30 ethnobotanical plant species in Sada Shiv sacred grove, located in Shivalik ranges of district Kangra. Rani et al. (2013) found that 30 polypetalous plant species are commonly used by local people for curing various diseases in district Kangra. Kumar (2021) discussed the diversity, distribution and aspect of wild fruit species from the foothill region of Dhauladhar Range, Kangra Valley.

RESEARCH GAP IDENTIFICATION:

Review of literature reveals that many ethnobotanical studies have been conducted in District Kangra. But no ethnobotanical work has been done in Nurpur Forest Division of district Kangra. The valley has distinct topography, climate and land use patterns. The rural, native and tribal people of the region use local plants for preparation of traditional dishes and medicinal purposes which have not been documented so far. Therefore present study will serve to bridge the gap on the following aspects:

- Identification of angiosperms of traditional use practices and their ethnobotanical knowledge.
- Study of utilization pattern of angiosperms of ethnobotanical importance.
- Corroboration and analysis of ethnobotanical information obtained from local healer to conserve this information for future generations, for further studies and as potential source for new drugs.

OBJECTIVES:

The main objectives of ethnobotanical study on angiosperms of Nurpur Forest Division in District Kangra of Himachal Pradesh are:

1. To study the diversity of ethnobotanical angiosperms.
2. To document the indigenous use of ethnobotanical angiosperms.
3. To document the utilization pattern of ethnomedicinal angiosperms.

PROPOSED METHODOLOGY:

Study Area:

Nurpur forest division is located in district Kangra of Himachal Pradesh. It is situated in Shivalik range of Himalayas and in northwest of district Kangra (Himachal Human Development report, 2002). Nurpur forest division is located at 32.18˚N 75.53˚E. It has average elevation of 643 metres (2109 feet) (Jerath & Ashok, 2000). Average rainfall is 1163mm. Average Temperature of Nurpur in summer is 31.97˚C (The Global Historical Weather and Climate Data, 2021). Earlier Nurpur was known with the name of Dhameri. In 1622, the name of the town was changed to Nurpur in honor of the Mughal queen who fell in love with the beauty of the valley (Hutchinson, 1933). Geographically, Nurpur is a transition zone between the plains of eastern Punjab and mid Himalayas. It comprise dominantly of middle and upper Shivaliks, separated by a regional thrust (Sehgal & Nanda, 2002). Apart from longitudinal thrust plane, the region is traversed by transverse lineaments or faults viz. Dehar lineament and Gaj lineament (Sharma et al., 2013). According to Govt of Himachal Pradesh, Census Report (2011) administrable Nurpur forest division is among the three forest division of Dharamshala circle in district Kangra. Nurpur forest division itself consists of Nurpur, Indora, Jawali and Fathehpur tehsils of district Kangra (Fig 1). The study area includes approximately 1,405 km^2 area. Moreover many hamlets of Nurpur Division belong to Pathania clan, Gaddi's of Chamba and Gujjar communities (Gazetteer of Kangra, 2011). This region has rich floral diversity which deserves a sincere ethnobotanical work. Vegetation of Nurpur is facing impact of climate

change, modernization and decreasing number of traditional informants. Keeping this in view, the present study is planned to explore ethnobotanical plants of Nurpur Division of district Kangra. The results of the present study are expected to throw light on the ethnobotanical treasure of Nurpur Forest Division.

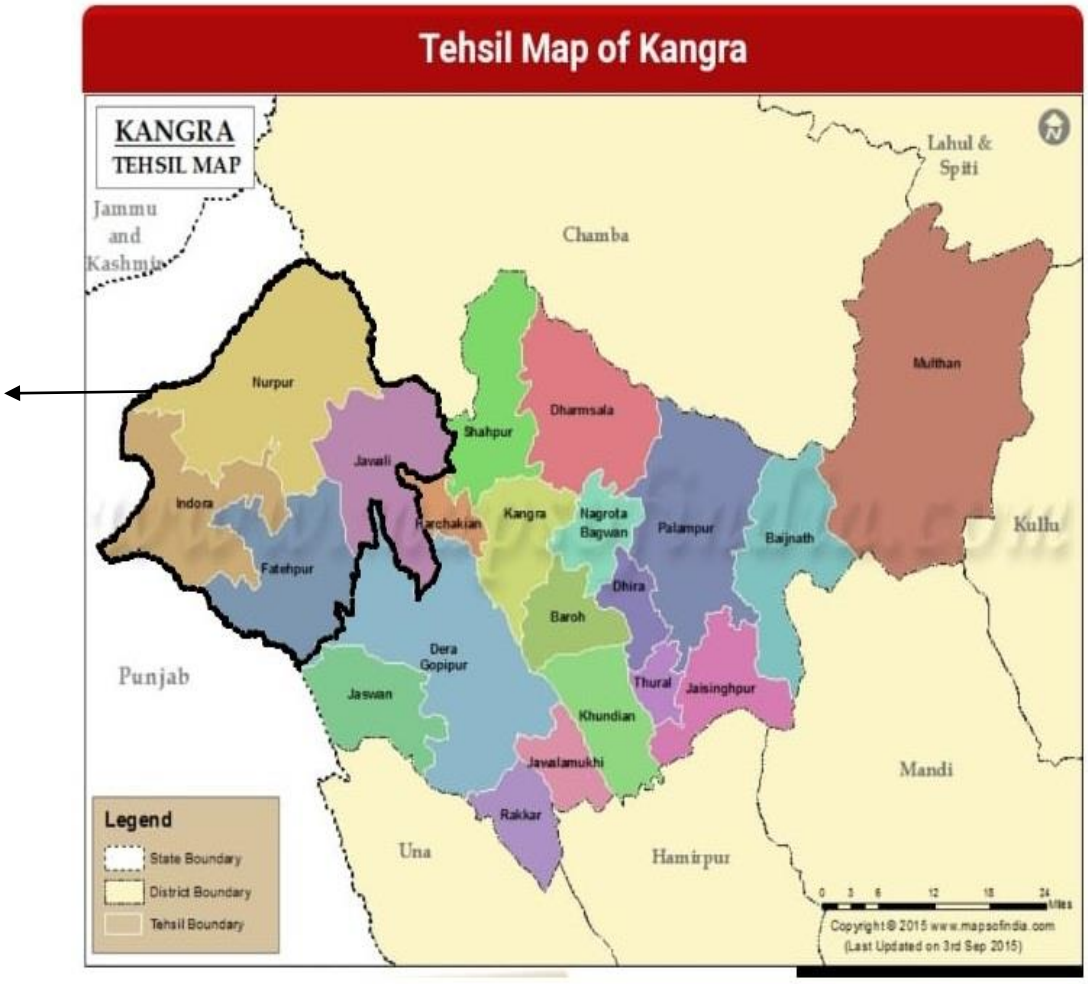

Fig 1: Map of District Kangra (Himachal Pradesh) showing Nurpur Division.
(Source of map - www.mapsofindia.com, 2015)

Informants' selection

The local inhabitants' information on the use of plants will be documented. On the basis of age Informants will be mainly divided into four groups: Teenagers (13-19 year), Adult (20-40 years), Middle age Adult (41-60 years) and Senior citizen (above 60 years) informants can be housemakers, working, farmers or traditional healers who are a resident in the Nurpur Division. The informants are choosen on the basis of their knowledge and interest on the ethnobotanical uses of the plants in their living area.

Field interviews

Intensive field surveys will be conducted for two years from August 2021 to July 2023. An ethnobotanical survey will be done through interviews using semi-structured questionnaires, observation and focus group discussions with informants of the Nurpur division. Ong and Kim (2014) explained that the semi- structured interviews allow researchers to gather a great deal of data from a large number of people. This approach allowed flexibility in the conversations and open exchanges with the informants (Schultz et al. 2020). Informants will be interviewed on an informal basis to maximize the source of information.

Collection of plant specimen, accession number, preparation of Herbarium and Identification

Intensive field trips will be conducted in study area to document the information of Angiospermic ethnobotanical plants. Information on different uses of ethnobotanical plants will be collected from the selected different age groups, 'Vaidyas' and the people of 'Pathania' clan, 'Gaddi' and 'Gujjar' community through Open-ended questionnaire, semi-structured interviews and discussions. The ethnobotanical important plants will be collected seasonally in flowering or fruiting stage with the help of informants. Standard taxonomical procedures will be followed in gathering of Angiospermic plants.

Collected plants will be gathered in five replicas in either blooming or fruiting stages. Plant specimens will be photographed for preparation of digitized in future. Plants will be pressed between newspapers treated with denatured alcohol that will sandwich in a wooden plant presser. Samples of the plant collected will be oven dried. Each dried plant specimen will be mounted on standard herbarium sheets using Polyvynilacetate (PVA) glue (Jain & Rao, 1977). This mounted specimen will be provided with accession number .The Families will be classified according to Bentham and Hooker Classification system. Identification will be done with the help of different Floras of Himachal Pradesh (Chowdhery & Wadhwa (1967); Arya & Kaur (2011) and with the help herbarium of different reputed organization of India. The collected material will be deposited in the Herbarium of the Carrer point university, Hamirpur, Himachal Pradesh. Data calculation will be tabulated including botanical name, synonym, local name, english and hindi name, family, description, distribution, habitat ecology, parts used and folk uses.

Questionnaire for collecting Ethnobotanical Data (Modified from Jain, 1987)

Questionnaire

Informant's details:

Name……

Gender……Age……

Age group: 13-19 year…..20-40 years…..41-60 years …..Above 60 year…

Occupation……

Education …….....

Village and Panchayat……

Contact Number and address……

Data about Plant and its uses:

Local name of plant……

Botanical Name of the plant……

Habitat/ collection time or season……

Plant parts used: 1) Leaves…

2) Flowers…

3) Roots…

4) Fruits…

5) Stem…

6) Others….

Cultivated/ Wild……

If cultivated, cultivated for…….

If Wild, availability in nature (easy/difficulty/very difficult)……

Conservation efforts by local people……

Method of collection and storage……..

Indigenous use……

Name of ailment treated……..

Method of crude drug preparation……

Mode of use……

Other uses (if any)……

Remarks:

Classification……

Informants' consent for the participation in the study:

I..... (name of informant) hereby give my full consent and conscious to participate in this study and declare that to the best of my knowledge the information that I have provided are true, accurate and complete.

Date..... (Signature/Thumb impression of Informant)

Sampling design

A probabilistic approach will be employed considering simple and stratified random sampling methods (Levy & Lemeshow, 2008). Sample selected by random methods: A non-probability sampling method implies the absence of any probabilistic mechanism in the sample selection. The plants sampling is done seasonally spring, summer, monsoon, autumn and winter.

Data analysis

Data will be statistically analyzed using various quantitative data analysis tools like Use Value (UV), Informant Consensus Factor (ICF), Relative Frequency of Citation (RFC) and Fidelity Level (FL).

Use Value (UV):

Using the results obtained in the general interview, the use value (UV) of the plant species will be calculated using the following formula:

$$UV_{is} = \Sigma U_{is}/n_{is}$$

Where UV_{is} = the use value of the species *s* mentioned by the informant *i*; ΣU_{is} = the number of uses of species *s* mentioned in each event by the informant *i*; n_{is} = the number of events in which the informant *i* cited species *s* (Phillips & Gentry, 1993).

Informant Consensus Factor (Fic):

Factor of informant consensus was computed using the following formula:

$$F_{ic} = N_{ur} - N_{taxa} / N_{ur} - 1$$

Where N_{ur} is the number of use reports in each category and N_{taxa} is the number of species in each category. It is calculated to know the agreement on the use of plants in various illness categories among the informants (Heinrich et al., 1998).

Frequency of citation (F):

Frequency of citation (F) of each medicinal plant species (Belayneh & Bussa, 2014) will be calculated using formula:

$$F\% = \text{Total no. of informants} \times 100$$

Relative Frequency of Citation (RFC):

The relative frequency of citation reveals the local importance of each medicinal plant species as used by the indigenous people to that area. Following formula used:

$$RFC = FC/N$$

Where FC is frequency of citation (the number of informants mentioning a useful species) and N is total number of informants in the survey (Vitalini et al., 2013)

Fidelity level (FL %):

The percentage of informants claiming the use of a plant species for the same major purpose was estimated using the fidelity level index by the following formula ssz :

$$FL = I_p/I_u \times 100$$

Where Ip denotes to number of informants who indicate use of a species for the major ailments, Iu refers to total number of informants who mentioned the same plant for any other use (Friedman et al., 1986).

THESIS OUTLINE:

Chapter I	**Introduction**	This Chapter gives the background of the research topic.
Chapter II	**Review of Literature**	This Chapter will include an extensive review of literature highlighting previous work and methodologies adopted. This will also contain research gap and various objectives of current research work.
Chapter III	**Methodology**	This chapter will contain description of the study area. It will also contain the Methodology of present research work.
Chapter IV	**Results and Discussion**	This chapter will present the results of present research work and the results will be collated with previous research.
Chapter V	**Summary and Conclusion**	In this chapter summary and conclusion of Research work will be discussed.

Chapter VI	**References**	This chapter will enlist the resources that will be referred within the body of the Research work.

REFERENCES:

Abbasi, A. M., Khan, M. A., Shah, M. H., Shah, M. M., Parvez, A. & Ahmad, M. (2013) Ethnobotanical appraisal and cultural values of medicinally important wild edible vegetables of Lesser Himalayas- Pakistan. *Journal of Ethnobiology and Ethnomedicine.* 9 (11), 1-13. Available from: http://www.ethnobiomed.com /content/9/1/66 [Accessed 13th April 2021].

Almedia, C., Amorim, E., Albuquerque, U. & Maia, M. (2006) Medicinal plants popularly used in the Xingo region –a semi- arid location in Northeastern Brazil. *Journal of Ethnobiology and Ethnomedicine*. 2 (15), 1-7. Available from: https:// ethnobiomed.biomedcentral.com/articles/10.1186/1746 [Accessed19thApril 2021].

Amiri, M. S., Joharchi, M. R., Nadaf, M. & Nasseh, Y. (2020) Ethnobotanical knowledge of Astragalus spp: The world's largest genus of vascular plants. Avicenna *Journal of Phytomedicine*. 10 (2), 128. Available from: https://www.ncbi.nlm.nih. gov/pmc/articles/PMC7103437 [Accessed 13th May 2021].

Arya, V. & Kaur, R. (2011) *Kangrian Medicinal Flora*. Delhi, Pranav Prakashan. ISBN: 9788192265902.

Balakrishnan, V., Prema, P., Ravindran, K. C. & Robinson, J. P. (2009) Ethnobotanical studies among villagers from Dharapuram taluk, Tamil Nadu, India. *Global Journal of Pharmacology*. 3 (1), 8-14.Available from: https://hamybalakrishnan/publication/240 [Accessed 12th June 2021]

Belayneh, A. & Bussa, N. F. (2014) Ethnomedicinal plants used to treat human ail-ments in the prehistoric place of Harla and Dengego valleys, eastern Ethiopia. *Journal of Ethnobiology and Ethnomedicine*. 10 (1), 1-17**.** Available from: https://ethnob/1746 [Accessed 5th June 2021]

Belgica, T. H., Suba, M. and Alejandro, G. J. (2021) Quantitative ethnobotanical study of medicinal flora used by local inhabitants in selected Barangay of Malinao, Albay, Philipines. *Biodiversitas Journal of Biological Diversity*. 22 (7), 2771-2721.Available from: dio:10.13057/biodiv/d220720u.

Bharadwaj, J. & Seth, M. K. (2017) Medicinal plant resources of Bilaspur, Hamirpur and Una districts of Himachal Pradesh: An ethnobotanical enumeration. *Journal of Medicinal Plants Studies*. 5 (5), 99-110. Available from: https://www.plantsjournal [Accessed 12thJuly 2021].

Bhattacharyya, R., Medhi, K. K., Borthakur, S. K. & Borkataki, S. (2020) An ethnobotanical study of medicinal plants used against Jaundice by tea tribes of Morigaon district, Assam (India). *Journal of Natural Remedies*. 20 (1), 16-22. Available from: http://www.informaticsjournals.in/index. [Accessed 8th April 2021].

Chauhan, N. S. (2003) Important medicinal and aromatic plants of Himachal Pradesh. *IndianForester*.129, 979-998.Available from: http://www.inex.php/indianforester/2364 [Accessed 2nd May 2021].

Chowdhery, H. J. & Wadhwa, B. M. (1984) *Flora of Himachal Pradesh*. Delhi, Botanical Survey of India.

Choudhary, K., Singh, M. & Pillai, U. (2008) Ethnobotanical survey of Rajasthan -an update. *American-Eurasian Journal of Botany*.1 (2), 38-45. Available from: doi: 10.1.1.516.5799&rep=rep1&type=pdf [Accessed 18th April 2021]

Chattopadhyay, D. (2010) *Ethno medicine: a source of complementary therapeutics a review*. Trivandrum, Research Signpost Trivandrum. ISBN: 978-81-308-0390-6.

Dhal, N. K., Panda, S. S. & Muduli, S. D. (2014)Ethnobotanical studies in Nawarangpur district, Odisha, India. *Annual Journal of Phytomedicine, Clinical Therapeutics*. 2, 257-276. Available from: http://citeseerx.ist.psu.edudo21&rtype=pdf [Accessed 20th April 2021].

Farooq, A. G., Saggoo, M. I. S. & Dar, M. A. (2014) Ethno botany of some selected Monochlamydeae plant species from the Kashmir Himalayas, India. *Journal of Medicinal Plant Research*. 8 (23), 834-839. Available from: https://doi.org/10.5.5470 [Accessed 8th June].

Firedman, J., Yaniv, Z., Dafni, A., and Palewitch, D. (1986) A preliminary classification healing potential plants, based on a rational analysis of an ethno pharmacological field survey among Bedouins in the Desert, Israel. *Journal of Ethnopharmacology*. 16, 275-287. Available from: https://www.sciencedirect.690094 [Accessed 7th May 2021].

Gazetter of Kangra (2011) Available from: https://hpkangra.nic.in/document-category/kangra-gazetter [Accessed 18th June 2021].

Gogtay, N. J., Bhatt, H. A., Dalvi, S. S. and Kshirsagar, N. A. (2002) The use and safety of non-allopathic Indian medicines. *Drug Safety*. 25 (14), 1005-1019.Available from: https://link.springer.com/article/225140-00003 [Accessed 8th June 2021].

Heinrich, M., Ankli, A., Frei, B. and Weimann, C. (1998) Medicinal Plants in Mexico: healer's consensus and cultural importance. *Social Science and Medicine*. 47, 1859-1871.Available from: https://d1wqtxts1xzle7/3/Heinrich_et_al_1998_SocScMed47-with-cover-page-v2.pdf? [Accessed 16th July 2021].

Himachal Pradesh Human Development Report (2002) Available from: http://hdr.undp.org/en/content-pradesh-human-develo [Accessed 10th August 2021].

Hutchinson, J. & Vogel J. P. H. (1933*) History of the Panjab Hill States*, Vol.1.1st edition: Govt. Printing, Punjab, Lahore, 1933. Reprint 2000. Department of Language and Culture, Himachal Pradesh. Chapter 6 Nurpur State, pp.213-267. Available from: https://books.google.co.in/books?hl=en&lr=&id=3btDw4S2FmYC&oi=fnd&pg=PA1&dq=Hutchinson [Accessed 18th June 2021].

Imperial Gazetteer of India. Vol 19, p.232. Available from: https://dsal.uchicago.gif [Accessed 2nd July 2021].

Jain, S. K. (1987) *A Manual of Ethnobotany*. Jodhapur, India. Scientific Publishers.

Jain, S. K. & Mudgal, V. (1999) *A Handbook of Ethnobotany*, Bishen Singh Mahendra Pal Singh, Dehradun-248001. pp.309, ISBN : 81- 211-0177-8.

Jain, S. K. & Rao, R. R. (1977) *A Handbook of Field and Herbarium Methods*. New Delhi, India: Today and Tomorrows Publications. ISBN13: 97-88170195436.

Jerath & Ashok (2000) Forts on the left side of Ravi. In: *Forts and Palaces of the western Himalayas.* Indus Publishing Company. p.27, ISBN: 9788173871047.

Kala, C.P. (2009) Aboriginal uses and management of ethnobotanical species in deciduous forests of Chhattisgarh state in India. *Journal of Ethnobiology and Ethnomedicine*. *5* (1), 1-9. Available from: https://link.springer.com/pdf/10.1186/1746-4269-5-20.pdf [Accessed 23rd June 2021].

Kala, C. P. & Mathur, V. B. (2002) Patterns of plant species distribution in the Trans Himalayan region of Ladakh, India. *Journal of Vegetation Science*. 13, 751–754. Available from: https://d1wqtxts1xzle7.cloudfront.net/44 [Accessed 20th June 2021].

Kanta, C., Sharma, I. P. & Shiekh, M. A. (2018) Ethnobotanical studies on medicinal plants of Langate area, Kupwara, Jammu and Kashmir, India. *Journal of Medicinal Plants Studies*. 6 (2*)*, 94-97. Available from: https://d1.cloudfranicalmedicinKupwara [Accessed 27th April 2021].

Kim, J. Y., Pham, D. D. & Koh, B. H. (2011) Comparison of Sasang constitutional medicine, traditional chinese medicine and Ayurveda. *Evidence Based Complementary and Alternative Medicine 2011*. 1-6.Available from: https://doi.org/10.1093/ecam/neq2 [Accessed 7th April 2021].

Kumar, P. (2021) Spatial Distribution and Ethno-botanical Aspect of Edible Plant from Foothill Region of Dhauladhar Range, Kangra Valley, North-Western Himalaya, India. *Journal of Biodiversity*, 12 (1-2), 12-1. Available from: https://www.researchgaValley-North-Western [Accessed 26th June 2021].

Levy, P. S. & Limeshow, S. (2008) *Sampling of population: Methods and application.* New York, John Wiley & Sons.

Miya, M. S., Timilsina, S. & Chhetri, A. (2020) Ethnomedicinal uses of plants by major ethnic groups of Hilly Districts in Nepal: A review. *Journal of Medicinal Botany*. 4, 24-37. Available from: doi:10.25081/jmb.2020.v4.6389.

Negi, V. M. & Chauhan, N. S. (2009) Medicinal and aromatic plants wealth of a tribal district Kinnaur in Himachal Himalayas. *Indian Forester*. 135 (6), 838-852. Available from: https://www.cabdirect.org//abstract/20093280713 [Accessed 26th April 2021].

Oommen, M. A. & Shanker, K. (2005) Elevational species richness patterns emerge from multiple local mechanissms in Himalayan woody plants. *Ecology*. 86, 3039-3047. Available from: https://www.dakshin.org/wpt/oommen_shan [Accessed 5th July 2021].

Pala, N. A., Banday, M., Islam, M. A., Rashid, M., Malik, Z. A. & Bussmann, R.W. (2021) Ethnobotanical Utilization of Forest Resources in Sindh Forest of Kashmir Himalaya, India. *Ethnobotany Research and Applications*. 21(1), 1-18. Available from: http://dx.doi.org/10.32859/era.2 [Accessed 9th June 2021].

Pal, D. K., Dutt, B. & Attri, R. D. (2020) Studies on traditional medicinal plants in mid Himalayan region of Himachal Pradesh. *Journal of Pharmacognosy and Phytochemistry*. 9 (5), 876-883. Available from: https://www.phytojournal./2020/10-1-32-386.pdf [Accessed 8th August 2021].

Park, H. L., Lee, H. S., Shin, B. C., Liu, J. P., Shang, Q., Yamashita, H. & Lim, B. (2012) Traditional medicine in China, Korea, and Japan: a brief introduction and comparison. *Evidence-based complementary and alternative medicine*. Available from: https://doi.org/10.1155/2012/429103 [Accessed 14th April].

Phillips, O. & Gentry, A. H. (1993) The useful plants of Tambopata, Peru: II. Additional hypothesis testing in quantitative ethnobotany. *Economic Botany*. 47, 33–43. Available from: doi: 10.1007/BF02862204

Radha, S. P. & Pundir, A. (2019) Survey of Wild Medicinal Plants used by Migratory Shepherds in Summer Hill of District Shimla in Himachal Pradesh. *Bio Bulletin.* 5 (1), 18-24. Available from: https://www.biobulletin.com%20used%20by%20Migratory [Accessed 15th July 2021].

Raghuvanshi, D., Dhalaria, R., Sharma, A., Kumar, D., Kumar, H., Valis, M., Kuca, K., Verma, R. & Puri, S. (2021) Ethnomedicinal Plants Traditionally Used for the Treatment of Jaundice (Icterus) in Himachal Pradesh in Western Himalaya-A Review. *Plants. 10* (2), 232. Available from: https://doi.org/plants10020232 [Accessed 25th March].

Ramkumar, T. R. & Karuppusamy, S. (2021) Plant Diversity and Ethnobotanical Knowledge of Spices and Condiments. In: Upadhyay., S. K. & Singh., S. P. (eds.) *Bioprospecting of Plant Biodiversity for Industrial Molecules*. Wiley, pp. 231-313. [Accessed 20th March 2021].

Rani, S., Rana, J. C., Jeelani, S. M., Gupta, R. C. and Kumari, S. (2013) Ethnobotanical notes on 30 medicinal polypetalous plants of district Kangra of Himachal Pradesh. *Journal of Medicinal Plants Research*, 7 (20), 1362-1369. Available from: https://academicjournals.org/journal/JMPR/article-full [Accessed 18th May 2021].

Rao R. R & Jamir N. S. (1982) Ethnobotanical studies in Nagaland. *Indian medicinal plants. Economic Botany.* 36, 176-181.Available from: https://link.springerBF0285871 [Accessed 24th June 2021].

Reddy K. N., Raju, G. V., Reddy, C. S & Raju, V. S. (2005) Ethnobotany of certain orchids of Eastern Ghats, Andhra Pradesh. *ENVIS News Letter*. Vol II (3), 5-9. Available from: https://www.researchgate/Sudhakar-Reddy-C/publication/258911375 [Accessed 26th May 2021].

Schultz, F., Anywar, G., Wack, B., Quave, C. L. & Garbe, I. A. (2020) Ethnobotanical study of selected medicinal plants traditionally used in the rural greater Mpigi region of Uganda. *Journal of Ethnopharmacol*. 28 (256), 12742. Available from: dio: 10.1016/j.jep.2020.112742 [Accessed 12th December].

Sehgal, R. K. & Nanda, A. C. (2002) Age of the fossiliferous Siwalik sediments exposed in the vicinity of Nurpur, District Kangra, Himachal Pradesh. *Current Science.* 82 (4), 392-395.Available from: https://www.researchgate.net/publication/sediment [Accessed 12th May 2021].

Sharma, B. D. & Rana, J. C. (1999) Traditional uses of Plants of Himachal hills. *Journal of Economic and Taxonomic Botany.* 23 (1), 173-176. Available from: https://books.google.co.in/books?hl=en&lr=fnd&pg=PA [Accessed 26th April 2021].

Sharma, D. K., Kumar, A., Kumar, A., Dhar, S. & Singh, S. (2013) Geological significance of radon gas in soil and underground water: A case study of Nurpur area, District Kangra, Himachal Pradesh, India. *Radiation Protection and Environment*. 36 (1), 3. Available from: https://www.rpe.org.in/article.0972-=2013;volume=36;issue [Accessed 12th May 2021].

Sharma, P., Santvan, V. K., Sharma, A. & Sharma, B. P. (2014) Ethno botanical Studies of Sada Shiv Sacred Grove, District Kangra, Himachal Pradesh. *Life Science leaflet*. 53, 89-96. ISSN 2277-4297.

Sheng-Ji, P. (2001) Ethnobotanical approaches of traditional medicine studies: some experiences from Asia. *Pharmaceutical biology*. 39 (sup1), 74-79. Available from: https://www.tandfonline.com/doi/pdf/10.1076/phbi.39.s1.74.0005 [Accessed 8th July].

Singh, A. K., Raghubanshi, A. S. & Singh, J. S. (2002) Medical ethnobotany of the tribals of Sonaghati of Sonbhadra district, Uttar Pradesh, India. *Journal of ethnopharmacology*. 81(1), 31-41. Available from: https://www.researchgate.net//J-S-ethnobotany [Accessed 12th June 2021].

Singh, G. S. (2000) Ethnobotanical study of useful plants of Kullu district in North Western Himalaya, India. *Ethnobotany and Medicinal Plants of Indian Subcontinent*, pp.185-198.Available from: http//google.co.in/book.india.Bot [Accessed 20th March].

Tefera, B. N. & Kim, Y. D. (2019) Ethnobotanical study of medicinal plants in the Hawassa Zuria District, Sidama zone, Southern Ethiopia. *Journal of ethnobiology and ethnomedicine*. 15 (1), 1-21. Available from: https://link.springer.com/article/10002 [Accessed 5th April].

The Global Historical Weather and Climate Data. (2021) Available from: https://tcktcktck.org/india/himachal-pradesh [Accessed on 19th December 2021].

Tribal Development Department, Govt of Himachal Pradesh.Shimla-2 (2011) *Directory of villages having concentration of Scheduled tribe population excluding scheduled areas in Himachal Pradesh.* 2011 census. Available from: http://himachalservices.nic.in [Accessed on 28th December 2021].

Tripathi, A. N., Kumar, P. & Sati, S. C. (2020) Uses of invasive alien plants in Kumaun Himalayan Folk medicinal system. *International Journal of herbs* and

medicine. 8 (1), 27-31. Available from: https//www.researchgatePlants_Fock_Kumaun [Accessed 6th June 2021].

Uniyal , S. K., Singh, K. N., Jamwal, P. & Brij, L. (2006) Traditional use of medicinal Plants among the Tribal communities of Chhota Bhangal, Western Himalaya. *Journal of Ethnobiology and Ethnomedicine*. 2, 14. Available from: https://link.springer.1746-4269 [Accessed 8th May 2021].

Vitalini, S., Iriti, M., Puricelli, C., Ciuchi, D., Segale, A., & Fico, G. (2013) Traditional knowledge on Medicinal and Food Plants used in Val San Giacomo (Sondria, Italy)-An Alpine ethnobotanical study. *Journal of Ethno pharmacology*. 145 (2), 517-529**.** Available from: https://doi.org/10.1016/2012.11.024 [Accessed 15th May 2021].

Wang, Q., Zhao, L., Gao, C., Zhao, J., Ren, Z., Shen, Y., Yao, R. & Yin, H. (2021) Ethnobotanical study on herbal market at the Dragon Boat Festival of Chuanqing people in China. *Journal of Ethnobiology and Ethnomedicine*. 17 (1), 1-16. Available from:https://ethnobiomed.biomedcentral.com/articles00447-[Accessed 26th March].

World Health Organisation (2013) *WHO Traditional Medicine Strategy 2014-2023*. Availablefrom:http://www.who.int/medicines/publications/traditional/trm_strategy14_23/en/ [Accessed 26th March].

CERTIFICATE
(SYNOPSIS APPROVAL CERTIFICATE)

This is to certify that the Revised Synopsis for Ph.D. Thesis titled, **" Ethnobotanical Study on Angiosperms of Nurpur Forest Division in District Kangra of Himachal Pradesh"**, submitted by **Ms. Anupriya Sharma** to the Career Point University, Hamirpur (H.P.), India in partial fulfillment of the requirements for the degree of **DOCTOR OF PHILOSOPHY** in the Division of Botany, Department of Bio Sciences, School of Basic and Applied Sciences has been approved by the Research Advisory Committee (RAC) after an Oral Examination of the student on dated 26th July 2021.

Dr. Arti Sharma
Assistant Professor, Division- Botany
Department of Bio Sciences
(Supervisor)

Research Advisory Committee

Dr. Hem Chander
Assistant Professor, Division- Botany
Department of Bio Sciences
(Member)

Dr. Kuldeep Kumar
Associate Professor
Department of Chemistry
(Member)

Dr. Shikha Kumari
Assistant Professor, Division- Microbiology
Department of Pharmacy
(Member)

Dr. Arti Sharma
Assistant Professor, Division- Botany
Department of Bio Sciences
(HOD)

01/01/2022
Dr. Yogesh Kumar Walia
Professor, Department of Chemistry
(Dean/Assoc Dean R & D)